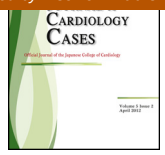
Journal of Cardiology Cases 9 (2014) 18–21

Journal of Cardiology Cases

journal homepage: www.elsevier.com/locate/jccase



Case Report

Nonobstructive angioscopy in patient with atherosclerotic renal artery stenosis

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ARTICLE INFO

Article history:
Received 1 August 2013
Received in revised form 19 August 2013
Accepted 26 August 2013

Keywords:
Renal artery stenosis
Nonobstructive angioscopy
Yellow plaque
Intravascular ultrasound
Computed tomography angiography

ABSTRACT

Few applications of angioscopy for evaluating atherosclerosis of the abdominal aorta have been described. We report the demonstration of atherosclerotic yellow plaque by nonobstructive angioscopy in a patient with left renal artery stenosis. Computed tomography angiography showed stenosis in one of the left renal arteries in a 65-year-old man who presented with renal impairment and hypertension. Invasive selective renal angiography indicated severe stenosis in the proximal portion of the inferior left renal arteries. Intravascular ultrasound demonstrated eccentric plaque with predominant low-density plaque with calcification as the culprit. Percutaneous transluminal renal angioplasty with stent implantation of the left renal artery was performed. Nonobstructive angioscopy demonstrated a grade 3 yellow culprit plaque at the proximal end of the stent, and grade 2 and grade 1 yellow plaques as the culprit plaques at the middle and distal portions of the artery, respectively.

<**Learning objective:** Atherosclerotic renal artery stenosis characterized by lipid-rich plaque and yellow plaque was diagnosed by intravascular imaging, such as intravascular ultrasound and angioscopy. As the stenosis was hemodynamically significant, percutaneous transluminal renal angioplasty was successfully performed. Nonobstructive angioscopy may be potentially applied for monitoring of transluminal ablation of the renal artery sympathetic nerves during drug-resistant hypertension.>

Introduction

Renal artery stenosis is an independent predictor of adverse cardiovascular events such as myocardial infarction, stroke, and cardiovascular death [1]. The main cause of renal artery stenosis is atherosclerosis. Other causes include fibromuscular dysplasia, vasculitis, neurofibromatosis, congenital bands, extrinsic compression, and radiation [2]. Thus, vascular imaging of renal artery stenosis can prove useful in evaluating pathogenesis.

Case report

A 65-year-old man who presented with renal impairment and hypertension was admitted to our hospital. His blood pressure on admission was 156/98 mmHg. Serum blood urea nitrogen (BUN) and creatinine levels were 14.6 mg/dL and 1.10 mg/dL, respectively. As he was on medication comprising a calcium antagonist and aldosterone blocker administered by the previous hospital, his renin and aldosterone level were not measured.

The patient had diabetes mellitus, for which he was on medication, and a history of percutaneous transluminal angioplasty for bilateral iliac and femoral artery stenoses. For follow up of arteriosclerosis obliterans, computed tomography (CT) angiography using 64-row CT (VCT, GE Medical Systems, Milwaukee, WI, USA) was performed with a slice thickness of 0.625 mm, pitch of 1.375:1, and gantry rotation time of 0.4 s, and 40 ml of contrast medium (Omnipaque 350; Daiichi Pharmaceutical Co., Ltd., Tokyo, Japan) with 40 ml of saline chaser was injected with Dual Shot (Nemoto Kyorindo Co., Ltd., Tokyo, Japan). Although stents of the iliac and femoral arteries were patent, the patient demonstrated atrophy of the left kidney and variation of 2 separate left renal arteries originating from the abdominal aorta and inferior and superior poles of the kidney (Fig. 1A). The size of the left kidney was 72.3 mm × 49 mm. Stenosis of the proximal inferior renal artery was dominant compared to that of the superior artery (Fig. 1B). Cross-sectional grayscale images (Fig. 1C) and Plaque Map (Fig. 1D) [3] at 1-mm intervals

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1878-5409/$ – see front matter
http://dx.doi.org/10.1016/j.jccase.2013.08.014

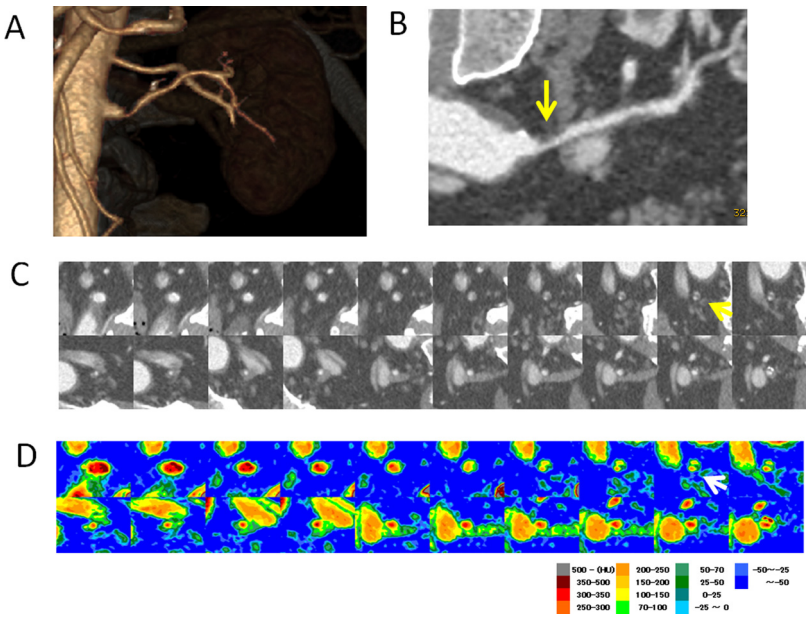

Fig. 1. (A) Volume rendering image of the left renal artery. Two left renal arteries originate from the abdominal aorta and inferior and superior poles of the kidney. (B) Curved multiplanar reformation image of the left inferior renal artery. Severe stenosis in the proximal portion of the left inferior renal artery is shown (arrow). (C) Cross-sectional grayscale images of the left inferior renal artery at 1-mm intervals. The culprit is indicated (arrow). (D) Plaque Maps of the left inferior renal artery at 1-mm intervals. At the site of severe stenosis, noncalcified plaques averaged 22 Hounsfield Units (HU) and 154 HU (arrows).

containing the culprit depicted severe stenosis and noncalcified plaques averaging 22 Hounsfield Units (HU) and 154 HU. Next, invasive selective renal angiography was performed. Angiographically, approximately 90% stenosis was found in the proximal portion of the inferior left renal arteries (Fig. 2A). Intravascular ultrasound using 3.2 Fr 45 MHz Revolution Catheter (Volcano Corp., San Diego, CA, USA) demonstrated eccentric plaque with predominantly low density, with a high-density area at the stenotic site (Fig. 3A). The area of the external elastic membrane, lumen area, and the percentage stenosis were 13.44 mm^2, 2.63 mm^2, and 80.4%, respectively. No thickening in media or adventitia was found. Compared to the Plaque Map CT image (Fig. 3B), low-density plaque was concordant with a lipid-rich component, and high-density plaque was thought to be composed of a fibrous to calcified component. As the stenosis was hemodynamically significant, percutaneous transluminal renal angioplasty was performed with implantation of a 4.0 mm × 15 mm stent following predilatation with a 3.5 mm × 20 mm balloon. Plaque was observed by nonobstructive angioscopy with a VISIBLE Fiber (Fiber Tech Co. Ltd., Tokyo, Japan), a Fiber Imaging System FT-203F (Fiber Tech Co. Ltd., Tokyo, Japan), and the Console (Intertec Medicals Co. Ltd., Osaka, Japan), using a previously described technique [4]. Yellow plaque was graded using a 5-point scale: 0, not yellow; 1, pale yellow; 2, yellow; 3, deep yellow; and 4, bright yellow.

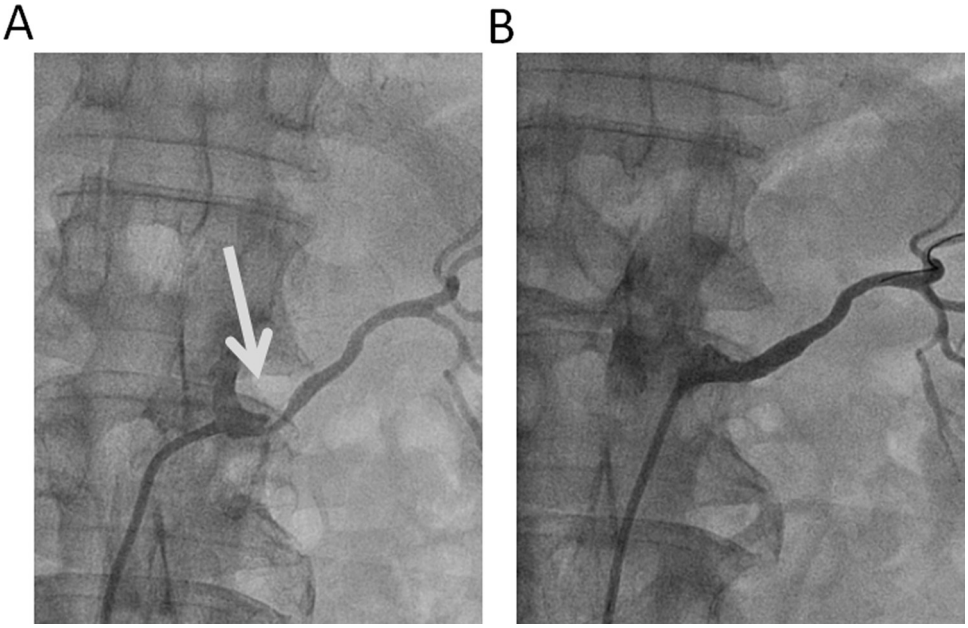

Fig. 2. Invasive selective renal angiographies of the left inferior renal artery before (A) and after (B) percutaneous transluminal renal angioplasty. Angiographically, approximately 90% stenosis was found in the proximal portion of the inferior left renal arteries (arrow).

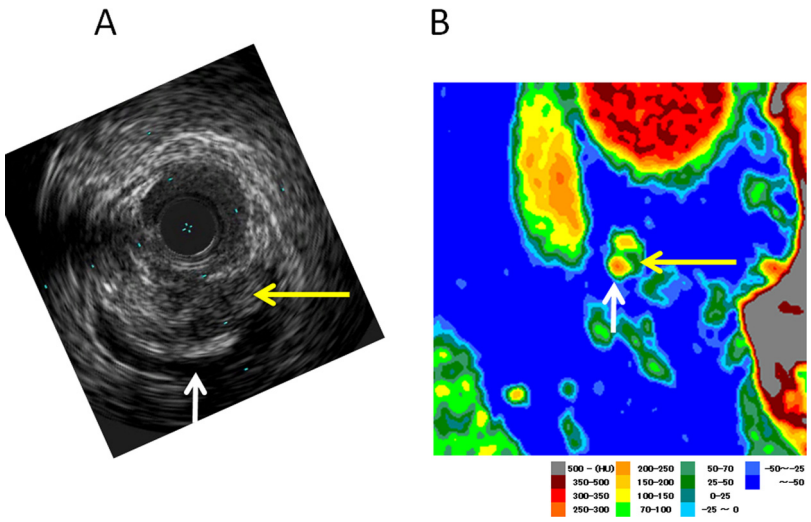

Fig. 3. Intravascular ultrasound image (A) of the culprit and Plaque Map of the corresponding image (B). Media or adventitia do not show thickening.

One grade 3 yellow plaque was identified at the proximal end of the stent (Fig. 4A), while grade 2 and grade 1 yellow plaques were observed at the middle and distal portions of the artery, respectively (Fig. 4B and C). Therefore, fibromuscular dysplasia and vasculitis were excluded. After successful percutaneous transluminal renal angioplasty (Fig. 2B), the patient's mean blood pressure decreased from 156/88 mmHg to 122/73 mmHg in the hospital. Electrolyte (sodium/potassium/chloride) before and after procedure were 140/4.5/107 mequiv./L and 140/4.0/108 mequiv., respectively. Serum BUN and creatinine levels improved to 15.9 mg/dL and 0.97 mg/dL, respectively. The size of left kidney was 75.4 mm × 49.5 mm after the procedure.

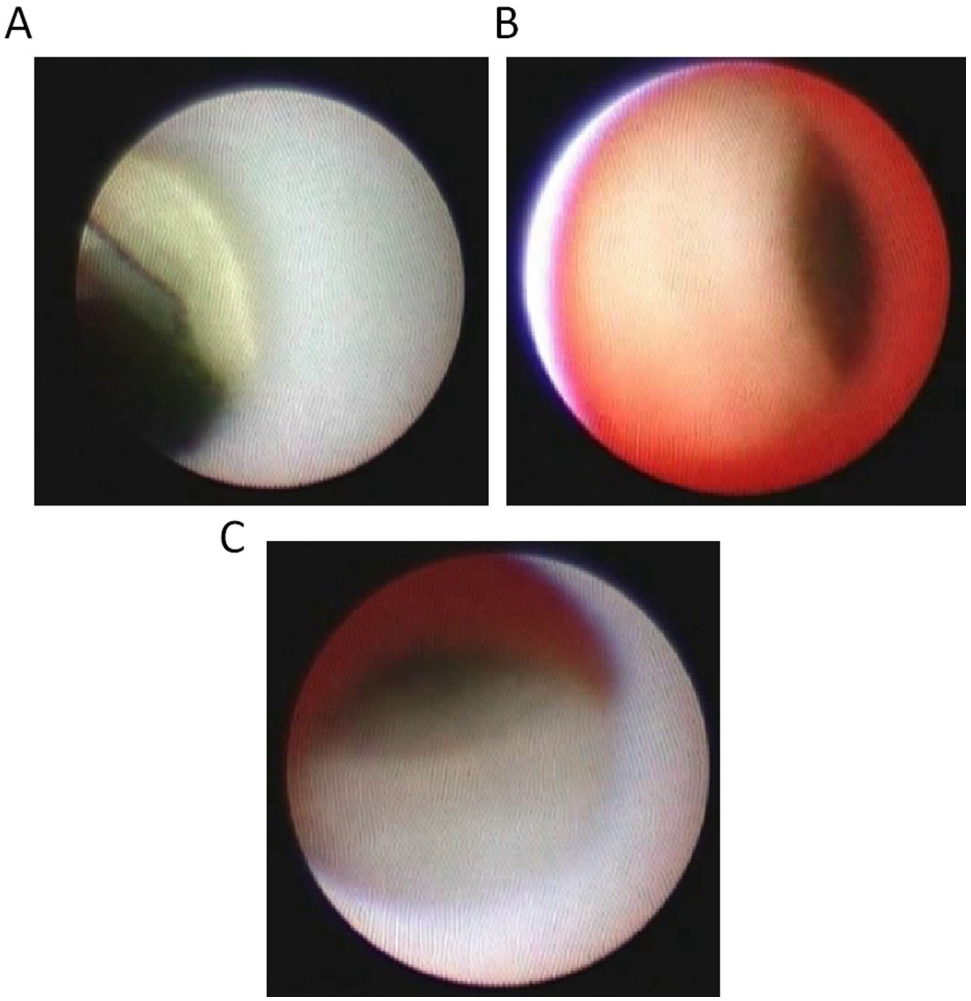

Fig. 4. Nonobstructive angioscopy images of the left inferior renal artery. Grade 3 yellow plaque behind the proximal end of the stent (A). Grade 2 and grade 1 yellow plaques at the middle (B) and distal (C) portions of the artery, respectively.

Discussion

Nonobstructive coronary angioscopy gives a full-color, three-dimensional perspective of the intracoronary surface morphology. The intensity of the yellow color of the plaques on nonobstructive coronary angioscopy, determined by the thickness of the fibrous cap, is known to be associated with plaque vulnerability [5]. There are few reports of aortic plaques observed by nonobstructive angioscopy in experimental and clinical settings [6,7]. To our knowledge, our report is the first to describe atherosclerosis of renal artery stenosis observed by nonobstructive angioscopy. Our patient had a deep yellow culprit plaque that was lipid-rich, suggesting that the plaque was atherosclerotic. A previous report demonstrated a fibromuscular dysplasia adventitial fibrotic band by intravascular ultrasound [8]. Distal embolization might occur in 24–35% of patients after percutaneous transluminal renal angioplasty [9]. Angioscopic findings might play a role in predicting the complication.

One of the potential applications of nonobstructive angioscopy for renal artery imaging may be to monitor transluminal ablation of the renal artery sympathetic nerves during drug-resistant hypertension [10]. Nonobstructive angioscopy for renal artery might also be useful for evaluating intimal change and monitoring complications such as pseudoaneurysms and renal artery dissection [11]. A recent study using optical coherence tomography [12] reported that endothelial-intimal edema and thrombus formation on the surface were detected after the procedure. Some unknown injury might be potentially detected also with nonobstructive angioscopy.

Conflict of interest

Authors declare no conflict of interest.

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